Compressed Gas Association
The Standard For Safety Since 1913

# CGA P-59—2015

## PREVENTION OF EXCESSIVE PRESSURE DURING FILLING OF CRYOGENIC VESSELS

SECOND EDITION

## PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has issued CGA P-59, *Prevention of Excessive Pressure During Filling of Cryogenic Vessels* jointly produced by members of the International Harmonization Council and originally published by the European Industrial Gases Association (EIGA) as EIGA Doc 151, *Prevention of Excessive Pressure During Filling of Cryogenic Vessels*.

This publication is intended as an international harmonized standard for the worldwide use and application of all members of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association (EIGA), and Japan Industrial and Medical Gases Association (JIMGA). Each association's technical content is identical, except for regional regulatory requirements and minor changes in formatting and spelling.

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NOTE—Technical changes from the previous edition are underlined.

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# 1 Introduction

This publication details the methods that can be used to prevent the overpressurization of both transportable and static cryogenic pressure vessels during filling.

# 2 Scope and purpose

## 2.1 Scope

This publication is intended to provide guidance to the filler/owner of either transportable or static cryogenic tanks, detailing the systems and procedures that can be used to prevent them being overpressurized during filling (i.e., causing a catastrophic failure by excessive pressure). Vessels for which the upper pressure limit (UPL) cannot be exceeded by the maximum allowable pump feed pressure (MAPFP) do not require any additional protection.

It is intended to address the issue of receiving vessels greater than 265 gal (1000 L) water capacity for liquid argon, nitrogen, oxygen, natural gas, helium, hydrogen, or ethylene. This publication should also be used for receiving vessels under 265 gal (1000 L) that are not designed for transport when full. This publication can also be used as guidance for other products and other transfer systems. It does not consider the hazardous nature of any product release, only the prevention of a failure of the tank due to pressure.

Protective measures that prevent the overpressurization of receiving vessels in service (e.g., by failure of the vacuum, pressure raising, flame engulfment, etc.) are detailed in other codes and standards, and are not considered further here.

## 2.2 Purpose

In 1996, a serious incident focused the attention of the gas industry on the fact that a cryogenic storage tank can be pressurized greater than its bursting pressure during filling. If a high pressure or high flow pump is used to fill a low pressure tank and if the safety measures are not appropriate or do not work, then an unsafe situation can arise.

This was the first significant incident of this type in an industry that has operated safely and reliably with an estimated several million filling operations carried out per year. However, due to recent technical developments in pumping equipment (increasing delivery pressures and flow rates), the safety margin the tanks have against failure can be reduced unless the protective measures against such an event occurring have not been upgraded simultaneously.

It is an essential management task to systematically control any changes to product transfer systems to ensure that the integrity of the tanks being filled is not jeopardized.

Pressure vessels are used in the distribution and site storage of cryogenic liquids on customer sites. This includes those involved in the transport of cryogenic fluids (transportable pressure vessels), such as road tankers, railroad tank cars transferring product from the production facility to the customers site, and those on the customer site itself (static pressure vessels) that provide on-site storage for the cryogenic fluids.

The primary means of controlling vessel pressure during an operator-attended fill is by a trained and qualified operator, making it a manually controlled process. Therefore, the case for the overpressurization scenario during operator-attended filling is outside the design code for sizing of pressure relief devices.

Overpressurization avoidance has been effected through operator procedures and training. This training includes, for example:

– initial and practical training verified by a qualification test; and

– re-examination and requalification verified by a selected driver inspector.

The safety record of filling operations indicates that the training of personnel has been exemplary based on historical performance. In order to accommodate the continuously improving capability of pumping systems, the